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Dental Anxiety: Prevalence and Evaluation of Psychometric Properties of a Scale

Juliana Alvares Duarte Bonini Campos*[a], Cristina Dupim Presoto[a], Carolina Scanavez Martins[a], Patrícia Aleixo dos Santos Domingos[a], João Maroco[b]

[a] Faculdade de Odontologia de Araraquara, UNESP – Universidade Estadual Paulista, São Paulo, Brasil. **[b]** ISPA – Instituto Universitário, Lisbon, Portugal.

Abstract

Aim: To estimate the reliability and validity of the Dental Anxiety Scale (DAS) and identify the prevalence and the effect of the socio-demographic characteristics of dental anxiety, in a sample of 212 adults. **Methods**: The psychometric sensitivity of the scale was assessed. A confirmatory factor analysis was performed, and the convergent validity and internal consistency were determined. The prevalence of anxiety was estimated, and the effect of socio-demographic variables on anxiety was assessed using structural equation modelling. **Results**: The participants' mean age was 33.5 (*SD* = 15.6) years, and 62.3% were female. There was an adequate factorial adjustment of the scale in this sample. The convergent validity and internal consistency were adequate in the one-factor model. Regarding two-factor model, there was a high correlation (r) among the factors, which jeopardized the discriminant validity. A total of 47.6% of the participants ($IC_{95\%}$ = 40.9 - 54.4) presented low levels of anxiety, 32.5% ($IC_{95\%}$ = 26.2 - 38.9) moderate levels, and 12.3% ($IC_{95\%}$ = 7.8 - 16.7) exacerbated levels. There was a non-significant effect of gender, age and education on the anxiety levels of this sample. **Conclusion**: We concluded that the one-factor model presented better psychometric qualities, that anxiety was highly prevalent and there was no significant effect of the demographic variables on anxiety, in this sample.

Keywords: dental anxiety, validation studies, prevalence

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*Corresponding author at: Faculdade de Odontologia de Araraquara, UNESP – Universidade Estadual Paulista, Rua Humaitá n. 1680, Centro – Araraquara (SP), Brasil. E-mail: jucampos@foar.unesp.br

Introduction

In Brazil, the information and studies on the prevalence of dental anxiety are scarce (Chaves, Loffredo, Valsecki-Júnior, Chavez, & Campos, 2006; Maniglia-Ferreira et al., 2004; Ramos-Jorge, Cardoso, Marques, Bosco, & Rocha, 2004; Rosa & Ferreira, 1997). However, its study is critical, as anxiety often results in missing, delaying or even cancelling dentist appointments (Malvania & Ajithkrishnan, 2011; Ng, Chau, & Leung, 2004; Vassend, 1993). Moreover, this emotional state can be prejudicial not only to the patient, but also the dentist, as it may be a source of professional stress, which can decrease the surgeon's performance in delicate procedures and complex treatments.

A prevalence of high dental anxiety was reported in 11% of a British sample (McGrath & Bedi, 2004), while this type of anxiety occurred in 31% of a Canadian sample (Locker, 2003). In Brazil, when the DAS scale was admin-

istered to 592 adults (Rosa & Ferreira, 1997), 15% of the sample was classified as highly anxious. About 17% of the 60 adult patients evaluated in the waiting room of a clinic, of the Faculty of Dentistry of Araraquara, also presented exacerbated anxiety levels (Chaves et al., 2006). An 18% prevalence of highly anxious patients was reported in a study in the University of Fortaleza (Maniglia-Ferreira et al., 2004), while 32.5% of 123 adolescents treated at the Federal University of Santa Catarina (Ramos-Jorge et al., 2004) reported dental anxiety.

Factors associated with dental anxiety have also been presented in the literature, namely, several studies have reported differences in its prevalence of between genders, with women being typically more anxious than men (Corah, Gale, & Illig, 1978; Rosa & Ferreira, 1997; Udoye, Oginni, & Oginni, 2005). It has also been reported that the level of anxiety tends to decline over the years (Hägglin, Berggren, Hakeberg, Hallstrom, & Bengtsson, 1999).

Thus, studies that aim at identifying dental anxiety's prevalence and associated factors can help improve the approach adopted during the consultations, and assist the professionals on how to proceed in order to ensure the patient's comfort.

It should be emphasized that such studies should use screening tools with adequate psychometric properties to ensure the quality of information collected. Regarding the use of the Dental Anxiety Scale (DAS) in different samples, no Brazilian papers were found where the data was based on the construct validity of "anxiety", concerning both the factorial and convergent validity, which are fundamental characteristics in data measurement and quality.

Regarding the 5-item modified DAS, the construct validity and reliability were asserted in detail (Yuan, Freeman, Lahti, Lloyd-Williams, & Humphris, 2008), however, this process was only carried out for the Chinese version of the instrument. Moreover, the internal consistency, reproducibility and the concurrent validity of the scale were also evaluated (Moore, Berggren, & Carlsson, 1991) in a Danish sample with 155 subjects, who presented an exaggerated fear of dentists. For the Turkish version of the scale the internal consistency, reproducibility and the concurrent validity were assessed, but the construct validity was not estimated (Tunc, Firat, Onur, & Sar, 2005). Finally, for the Portuguese version the internal consistency was asserted when the scale was applied to 747 adults (Hu, Gorenstein, & Fuentes, 2007), however, the construct validity was not determined.

Concerning the scale's factorial structure, the initial proposal indicates the construct as unifactorial (Corah, 1969). However, more recently it was argued (Yuan et al., 2008) that, due to their theoretical conceptualization, the scale's items should be divided in two factors: "anxiety prior to dental treatment" (questions 1 and 2) and "anxiety during dental treatment" (remaining questions). Thus, the authors presented evidence of the scale's construct validity when using a two-factor model, in a sample of Chinese individuals.

Thus, our study was carried out with the objective of estimating the reliability and validity of DAS when applied to a sample of adults, observed and treated in a moving clinic (set up in a commercial fair, in the city of Araraquara, SP), as well as to identify the prevalence and the effect of socio-demographic characteristics on dental anxiety.

Methods

Study and Sample Design

A cross-sectional study with non-probabilistic convenience sample was conducted. A total of 212 individuals from both genders, over 18 years old, who sought dental assistance at the University Centre of Araraquara - UNIARA

(in a moving clinic set up on the premises of the Commercial and Agro-Industrial Fair, in Araraquara, SP), participated in this study.

Variables and Instrument

A socio-demographic questionnaire was used to enable the sample's characterization regarding age, gender and educational level (Associação Brasileira de Empresas de Pesquisa, 2008). To identify the levels of anxiety, we used the cross-cultural Portuguese adaptation of the Dental Anxiety Scale (DAS) (Hu et al., 2007).

The scale contains four 5-point Likert-type questions. To obtain the overall score, the questions scores are added, and the individuals' anxiety levels are classified as null, low, moderate or exacerbated, using the proposed cut-off points (Corah, 1969).

The interviews were all conducted by the same interviewer, calibrated in a pilot study ($\kappa = 0.81$).

Analysis of the Psychometric Characteristics

We evaluated the items' psychometric sensitivity using descriptive measures (central tendency, variability and shape). Values of skewness lower than 3 and kurtosis lower than 7 in absolute value, were considered to indicate an adequate sensitivity and a non-significant deviation from normality (Maroco, 2010).

Construct validity was estimated by the factorial, convergent and discriminant validity, the latter being measured only for the two-factor model. To demonstrate the external validity of the factorial structure, the sample was subdivided into three parts: two parts formed the "Test Sample" and one part the "Validation Sample". In the first sample the factor structure was studied, and in the second the obtained structure was confirmed.

A confirmatory factor analysis was conducted to assess the quality of the adjustment of the one-factor (Corah, 1969) and the two-factor (Yuan et al., 2008) solutions. In order to assess the quality of the adjustment, the chi-square for the degrees of freedom (χ^2/df), CFI (confirmatory fit index), GFI (goodness of fit index) and RMSEA (Root Mean Square Error of Approximation), were calculated. To determine the invariance of the factor structure obtained in the "Test Sample", in the "Validation Sample", and in different genders, a multi-group analysis was performed (Maroco, 2010). All the analyses were performed using the program AMOS® 19.0 (SPSS Inc., Chicago, IL).

The convergent validity was estimated by the Average Variance Extracted (AVE) and by the Composite Reliability (CR), and the discriminant validity by correlational analysis (p^2) (Fornell & Larcker, 1981). The sample was then divided according to gender, and the factorial and convergent validity, as well as the invariance of the scale were once more estimated.

The internal consistency was assessed using the standardized Cronbach's alpha coefficient (α).

Data Analysis

Individuals were grouped according to their anxiety levels, and each category's prevalence was calculated by point and by confidence interval of 95%. The effect of the variables gender, age and education in dental anxiety were studied through multivariate linear regression, using structural equation modelling. The significance of the regression coefficients was evaluated after estimating the parameters using the maximum likelihood method. The level of significance was set at 5%

Ethical Aspects

This project was approved by the Research Ethics Committee of the University Centre of Araraquara (UNIARA), Protocol 380. The subjects who participated agreed and signed the Informed Consent Form.

Results

The participants' mean age was 33.5 years (*SD* = 15.6), and 62.3% were female. Regarding the level of education 86 (40.6%) had, at most, completed primary school, while 126 (59.4%) had higher levels of education.

Summary measures for each item of the DAS are presented in Table 1.

Table 1

Summary Measures for Each Item of the Dental Anxiety Scale (DAS Cross-Culturally Adapted Into Portuguese), Araraquara, 2011

	DAS	*M*	*Mdn*	*SD*	Minimum	Maximum	Skewness	Kurtosis
it1.	If you had to go to the dentist tomorrow, how would you feel?	2.23	2.00	1.00	1.00	5.00	1.20	1.32
it2.	When you're waiting, in the dentist's waiting room, how do you feel?	2.18	1.50	1.36	1.00	5.00	0.59	-1.23
it3.	When you're in the dental chair, waiting for the dentist to prepare the engine to work on your teeth, how do you feel?	2.42	2.00	1.31	1.00	5.00	0.42	-1.07
it4.	You are in the dental chair. While you're waiting for the dentist to get the instruments to scrape your teeth (near the gum), how do you feel?	2.42	2.00	1.34	1.00	5.00	0.49	-1.00

The skewness and kurtosis values indicate no significant deviations from normality.

The factor weights and the data's goodness of fit indices for the one-factor and two-factor structures, as well as the multi-groups analysis are presented in Table 2.

An appropriate factor adjustment of the samples is observed ($\lambda \geq 0.50$; *CFI* and *GFI* > 0.90), with only one limitation, the RMSEA in the female sample in both the one-factor model and the two-factor model. There was invariance between the Test Sample and the Validation Sample, and between genders ($p > 0.05$), denoting stability of the scale's factor structure. In the two-dimension model there was a high correlation (r) between the factors.

Table 3 presents the convergent validity and internal consistency of the data.

An adequate convergent validity (*AVE* > 0.50 and *CR* > 0.70), and internal consistency ($\alpha > 0.70$) of DAS can be observed in the sample when using the one-factor model. In the proposed two-factor model, there was no discriminant validity of the factors proposed (*AVE* < p^2). Given the limitations of the convergent and discriminant validity, and of the internal consistency regarding the two-factor model, we chose to use DAS considering only one-factor, in order to build the regression model.

Of the participants, 7.6% ($IC_{95\%}$ = 4.0 - 11.1) had no anxiety, 47.6% ($IC_{95\%}$ = 40.9 - 54.4) low anxiety levels, 32.5% ($IC_{95\%}$ = 26.2 - 38.9) moderate, and 12.3% ($IC_{95\%}$ = 7.8 - 16.7) exacerbated anxiety levels.

Table 2

Factor Weights (λ), Data's Goodness of Fit Indexes, and Multi-Group Analysis, Araraquara, 2011

							Invariance (*p*)		
	λ	r	χ^2/df	CFI	GFI	RMSEA	λ	Cov	Res
One-factor proposal									
Test Sample	0.50-0.92	-	1.621	0.995	0.989	0.066	-	-	-
Validation Sample	0.58-0.86	-	1.922	0.984	0.971	0.100	-	-	-
Multi-group analysis	0.52-0.91	-	0.980	1.000	0.974	<0.001	0.498	0.203	0.956
Gender									
Male	0.51-0.90	-	0.265	1.000	0.996	<0.001	-	-	-
Female	0.52-0.92	-	4.554	0.974	0.970	0.163	-	-	-
Multi-group analysis	0.52-0.91	-	1.629	0.980	0.959	0.055	0.626	0.246	0.146
Two-factor proposal									
Test Sample	0.47-0.92	0.97	1.373	0.999	0.995	0.051	-	-	-
Validation Sample	0.69-0.88	0.87	0.225	1.000	0.998	<0.001	-	-	-
Multigroup analysis	0.55-0.91	0.93	0.873	1.000	0.977	<0.001	0.257	0.511	0.562
Gender									
Male	0.50-0.90	0.89	0.443	1.000	0.997	<0.001	-	-	-
Female	0.56-0.94	1.00	5.880	0.982	0.979	0.192	-	-	-
Multigroup analysis	0.55-0.91	0.92	1.618	0.982	0.962	0.054	0.712	0.218	0.173

Note. r = correlation between dimensions.

Table 3

Average Variance Extracted (AVE), Composite Reliability (CR) and Standardized Cronbach's Alpha (α), Araraquara, 2011

	AVE	CR	p^2	α
One-factor proposal				
Test Sample	0.588	0.845	-	0.838
Validation Sample	0.576	0.841	-	0.834
Gender				
Male	0.529	0.812	-	0.799
Female	0.609	0.857	-	0.850
Two-factor proposal				
Test Sample	0.399	0.557	0.496	0.507-0.875
Validation Sample	0.550	0.709	0.476	0.694-0.871
Gender				
Male	0.323	0.485	0.496	0.457-0.827
Female	0.510	0.666	0.446	0.619-0.895

Figure 1 presents the adjusted regression model for the study's variables.

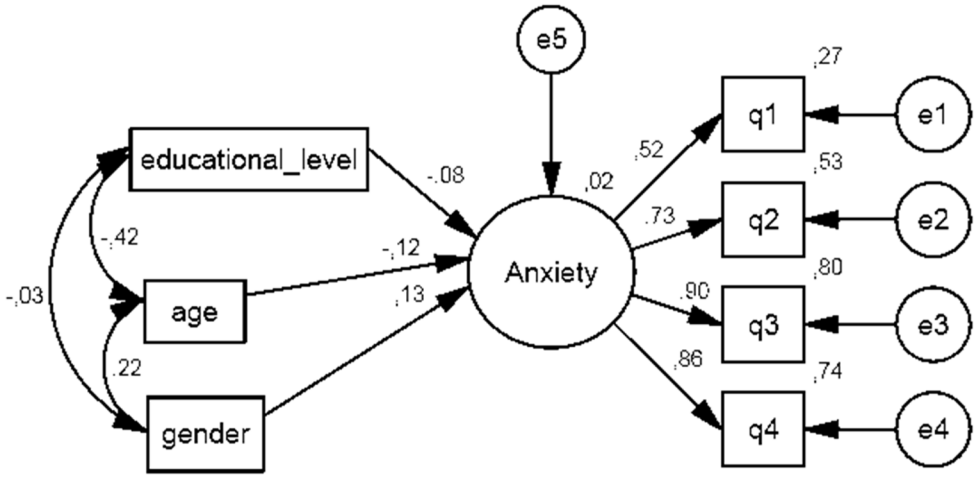

Figure 1. Regression adjusted model for study variables.

The adjusted model explained only 2% of the variability of dental anxiety. No trajectory was statistically significant.

Discussion

It is important to consider and understand dental anxiety, as it frequently leads to missing, postponing or even cancelling dentist appointments (Malvania & Ajithkrishnan, 2011; Ng et al., 2004; Vassend, 1993), and to the possible compromise of the individuals' oral health. It has been suggested that the assessment of the patients' dental anxiety is a valuable strategy in preventive programs aimed at a better patient integration and involvement in the process of oral health maintenance (Chaves et al., 2006).

In this study, we used the Dental Anxiety Scale (DAS) (Corah, 1969) as it is a simple, short and widely applied instrument in dental practice worldwide. However, when it comes to using psychometric scales for data collection, special attention should be given to the evaluation of their reliability and validity in the sample, as it is the only way to assess the quality of the collected data. Nevertheless, we did not find, in the literature, studies using the Portuguese version of DAS that adequately estimated the instrument's psychometric properties.

The results suggest adequate reliability and validity of DAS in this sample when using the one-factor proposal, which is stable in independent samples.

The comparison of our results with those from the literature is difficult, since we found no studies that used the full-scale validation. In the validation study for the Chinese version (MDAS) (Yuan et al., 2008), contrary to the present study, the two-dimension model provided a better fit (one dimension: χ^2/df = 41.24, *CFI* = 0.902, *GFI* = 0.902, *RMSEA* = 0.227; two dimensions: χ^2/df = 8.5, *CFI* = 0.985, *GFI* = 0.983, *RMSEA* = 0.098). However, the MDAS version presents 5 questions whose convergent and discriminant validity were not analysed. It is, therefore, not possible to assess whether the two-factor structure of the scale is justified.

When the scale was divided in two factors (dental anxiety before dental treatment: questions 1 and 2; anxiety during dental treatment: questions 3 and 4) there was a high correlation between them (Table 2), which explains the model's inadequate discriminant validity (Table 3). Reducing the number of questions in each factor also un-

dermined significantly the scale's internal consistency (Table 3). Thus, for the sample under study, the one-factor proposal of DAS presented better psychometric characteristics and, therefore, should be used.

The prevalence of anxiety in the sample was high (92.4%) confirming the findings of Chaves et al. (2006). However, the authors found that most respondents (53.3%) had moderate levels of anxiety, while in our study most of the participants showed a low level of dental anxiety, which may be due to the fact that the latter is a normative sample while the first was conducted in patients in the waiting room of the Integrated Clinic of a Dentistry University.

The prevalence of exacerbated dental anxiety is consistent with what was observed in England (McGrath & Bedi, 2004), India (Malvania & Ajithkrishnan, 2011) and Brazil (Maniglia-Ferreira et al., 2004; Rosa & Ferreira, 1997).

The high levels of anxiety suggested by DAS evidence a significant problem for dental professionals, and may lead to difficulties in the conditioning and cooperation of the patient during treatment, jeopardizing the patient-professional relationship, requiring greater care by the dentist during the planning and execution of clinical stages, aiming at making the patients aware of the importance of their oral health, in each consultation (Maniglia-Ferreira et al., 2004).

Often, in the literature, studies relate dental anxiety to gender (Garip, Abalı, Göker, Göktürk, & Garip, 2004; Hu et al., 2007; Kanegane, Penha, Borsatti, & Rocha, 2003; Malvania & Ajithkrishnan, 2011; Muglali & Komerik, 2008; Quteish Taani, 2002; Rosa & Ferreira, 1997; Schuller, Willumsen, & Holst, 2003; Settineri, Tati, & Fanara, 2005; Singh, de Moraes, & Ambrosano, 2000; Udoye et al., 2005), age (Malvania & Ajithkrishnan, 2011; Thomson, Stewart, Carter, & Spencer, 1996; Yuan et al., 2008) and educational levels (Chaves et al., 2006; Malvania & Ajithkrishnan, 2011; Maniglia-Ferreira et al., 2004; Rosa & Ferreira, 1997), however, in this study's sample these characteristics were not good predictors of dental anxiety (Figure 1). Thus, other variables should be considered in the model and, for that, exploratory studies should be initially performed, in order to identify the specific social and/or behavioural characteristics that may be related to the theoretical construct of anxiety.

Conclusions

DAS presented adequate internal consistency, convergent and factorial validity of the one-factor model, in this sample, allowing its safe use to assess levels of dental anxiety.

Dental anxiety was a highly prevalent and there was no significant effect of gender, age and education on anxiety levels in the sample.

References

Associação Brasileira de Empresas de Pesquisa. (2008). *Critério de Classificação Econômica Brasil.* Retrieved from http://www.abep.org/novo/FileGenerate.ashx?id=250

Chaves, A. M., Loffredo, L. C. M., Valsecki Júnior, A., Chavez, O. M., & Campos, J. A. D. B. (2006). Estudo epidemiológico da ansiedade dos pacientes ao tratamento odontológico. *Revista de Odontologia da UNESP, 35*(4), 263-268.

Corah, N. L. (1969). Development of a dental anxiety scale. *Journal of Dental Research, 48*(4), 596. doi:10.1177/00220345690480041801

Corah, N. L., Gale, E. N., & Illig, S. J. (1978). Assessment of a dental anxiety scale. *The Journal of the American Dental Association, 97*(5), 816-819.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *JMR: Journal of Marketing Research, 18*(1), 39-50. doi:10.2307/3151312

Garip, H., Abalı, O., Göker, K., Göktürk, Ü., & Garip, Y. (2004). Anxiety and extraction of third molars in Turkish patients. *The British Journal of Oral & Maxillofacial Surgery, 42*(6), 551-554. doi:10.1016/j.bjoms.2004.08.001

Hägglin, C., Berggren, U., Hakeberg, M., Hallstrom, T., & Bengtsson, C. (1999). Variations in dental anxiety among middle-aged and elderly women in Sweden: A longitudinal study between 1968 and 1996. *Journal of Dental Research, 78*(10), 1655-1661. doi:10.1177/00220345990780101101

Hu, L. W., Gorenstein, C., & Fuentes, D. (2007). Portuguese version of Corah's Dental Anxiety Scale: Transcultural adaptation and reliability analysis. *Depression and Anxiety, 24*(7), 467-471. doi:10.1002/da.20258

Kanegane, K., Penha, S. S., Borsatti, M. A., & Rocha, R. G. (2003). Ansiedade ao tratamento odontológico em atendimento de urgência. *Revista de Saude Publica, 37*(6), 786-792. doi:10.1590/S0034-89102003000600015

Locker, D. (2003). Psychosocial consequences of dental fear and anxiety. *Community Dentistry and Oral Epidemiology, 31*(2), 144-151. doi:10.1034/j.1600-0528.2003.00028.x

Malvania, E. A., & Ajithkrishnan, C. G. (2011). Prevalence and socio-demographic correlates of dental anxiety among a group of adult patients attending a dental institution in Vadodara City, Gujarat, India. *Indian Journal of Dental Research, 22*(1), 179-180. doi:10.4103/0970-9290.79989

Maniglia-Ferreira, C., Gurgel-Filho, E. D., Bönecker-Valverde, G., Moura, E. H., de Deus, G., & Coutinho-Filho, T. (2004). Ansiedade odontológica: Nível, prevalência e comportamento. *Revista Brasileira em Promoção da Saúde, 17*(2), 51-55. doi:10.5020/18061230.2004.p51

Maroco, J. (2010). *Análise de equações estruturais*. Lisboa: ReportNumber.

McGrath, C., & Bedi, R. (2004). The association between dental anxiety and oral health-related quality of life in Britain. *Community Dentistry and Oral Epidemiology, 32*(1), 67-72. doi:10.1111/j.1600-0528.2004.00119.x

Moore, R., Berggren, U., & Carlsson, S. G. (1991). Reliability and clinical usefulness of psychometric measures in a self-referred population of odontophobics. *Community Dentistry and Oral Epidemiology, 19*, 347-351. doi:10.1111/j.1600-0528.1991.tb00185.x

Muglali, M., & Komerik, N. (2008). Factors related to patients' anxiety before and after oral surgery. *Journal of Oral and Maxillofacial Surgery, 66*(5), 870-877. doi:10.1016/j.joms.2007.06.662

Ng, S. K. S., Chau, A. W. L., & Leung, W. K. (2004). The effect of pre-operative information in relieving anxiety in oral surgery patients. *Community Dentistry and Oral Epidemiology, 32*(3), 227-235. doi:10.1111/j.1600-0528.2004.00161.x

Quteish Taani, D. S. M. (2002). Dental anxiety and regularity of dental attendance in younger adults. *Journal of Oral Rehabilitation, 29*(6), 604-608. doi:10.1046/j.1365-2842.2002.00905.x

Ramos-Jorge, M. L., Cardoso, M., Marques, L. S., Bosco, V. L., & Rocha, M. J. C. (2004). Associação entre experiência odontológica na infância e ansiedade odontológica na adolescência. *Arquivos em Odontologia, 40*(4), 291-301.

Rosa, A. L., & Ferreira, C. M. (1997). Ansiedade odontológica: Nível de ansiedade, prevalência e comportamento dos indivíduos ansiosos. *Revista Brasileira de Odontologia, 54*(3), 171-174.

Schuller, A. A., Willumsen, T., & Holst, D. (2003). Are there differences in oral health and oral health behavior between individuals with high and low dental fear? *Community Dentistry and Oral Epidemiology, 31*(2), 116-121. doi:10.1034/j.1600-0528.2003.00026.x

Settineri, S., Tati, F., & Fanara, G. (2005). Gender differences in dental anxiety: Is the chair position important? *The Journal of Contemporary Dental Practice, 6*(1), 115-122.

Singh, K. A., de Moraes, A. B. A., & Ambrosano, G. M. B. (2000). Medo, ansiedade e controle relacionados ao tratamento odontológico. *Pesquisa Odontologica Brasileira, 14*(2), 131-136. doi:10.1590/S1517-74912000000200007

Thomson, W. M., Stewart, J. F., Carter, K. D., & Spencer, A. J. (1996). Dental anxiety among Australians. *International Dental Journal, 46*(4), 320-324.

Tunc, E. P., Firat, D., Onur, O. D., & Sar, V. (2005). Reliability and validity of the Modified Dental Anxiety Scale (MDAS) in a Turkish population. *Community Dentistry and Oral Epidemiology, 33*(5), 357-362. doi:10.1111/j.1600-0528.2005.00229.x

Udoye, C. I., Oginni, A. O., & Oginni, F. O. (2005). Dental anxiety among patients undergoing various dental treatments in a Nigerian teaching hospital. *The Journal of Contemporary Dental Practice, 6*(2), 91-98.

Vassend, O. (1993). Anxiety, pain and discomfort associated with dental treatment. *Behaviour Research and Therapy, 31*(7), 659-666. doi:10.1016/0005-7967(93)90119-F

Yuan, S., Freeman, R., Lahti, S., Lloyd-Williams, F., & Humphris, G. (2008). Some psychometric properties of the Chinese version of the Modified Dental Anxiety Scale with cross validation. *Health and Quality of Life Outcomes, 6*, Article 22. doi:10.1186/1477-7525-6-22